

DaimlerChrysler AG

Patent Claims

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1. A method for cooling a fuel cell system having a fuel cell, which comprises an anode space, to which a hydrogen-containing gas is fed, and a cathode space, to which an oxygen-containing gas is fed via an air intake system, a cooling device, which forms part of a cooling circuit through which a liquid coolant is passed, being arranged at least in the fuel cell, characterized in that gaseous constituents contained in the liquid coolant are separated off in the cooling circuit outside the fuel cell and fed to the air intake system via a discharge passage which does not include any ignition sources for an ignitable gas mixture.

2. The method as claimed in claim 1, characterized in that coolant which emerges from the exit of the cooling device of the fuel cell is fed to a calming vessel, from which gas is discharged at a preset excess-pressure level, the gas being fed via the discharge passage to the mass flow of oxygen-containing gas of the air intake system, and which is closed when the pressure drops below the excess pressure level, in order to prevent gas from escaping to the discharge passage.

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3. The method as claimed in claim 1 or 2, characterized in that any gas which is present in the liquid coolant is separated out of the coolant upstream of the calming vessel by means of a vent line and is then fed into the calming vessel.

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4. The method as claimed in at least one of the preceding claims, characterized in that gases from the

discharge passage are fed to the mass flow of air in the region of an air filter of the air intake system.

5 5. The method as claimed in at least one of the preceding claims, characterized in that the hydrogen content of the exhaust gases from the fuel cell is monitored using a hydrogen sensor, and in that when a preset limit value for the gas content is reached, the concentration of hydrogen in the exhaust gas is reduced
10 to below the threshold value by admixing hydrogen-free gas.

15 6. The method as claimed in at least one of the preceding claims, characterized in that the exhaust gases from the fuel cell are passed over a catalyst, by means of which the hydrogen concentration in the exhaust gases is reduced.

20 7. The method as claimed in at least one of the preceding claims, characterized in that a compressor in the air intake system for feeding air into the fuel cell remains switched on after the fuel cell has been switched off and the circulation of coolant has been shut down, so that it continues running for a
25 predeterminable period of time.

30 8. The method as claimed in at least one of the preceding claims, characterized in that the calming vessel is purged with air before the coolant circuit is started up.

35 9. An apparatus for cooling a fuel cell system having a fuel cell, which comprises an anode space, to which a hydrogen-containing gas is fed, and a cathode space, to which an oxygen-containing gas is fed via an air intake system, a cooling device, which forms part of a cooling circuit through which a liquid coolant is passed, being arranged at least in the fuel cell, characterized in

that a calming vessel (23) for the liquid coolant with a gas collection region (22) is connected downstream of the outlet (19) or exit of the cooling device (15) of the fuel cell (1), in that a gas outlet valve (25) is
5 arranged at the gas collection region (22), which valve can be actuated at a predeterminable gas volume or gas pressure in the calming vessel (23) and on the exit side is connected, via a discharge passage (26) which does not include any ignition sources for an ignitable
10 gas mixture, to the intake system for the oxygen-containing gas.

10. The apparatus as claimed in claim 9, characterized in that a vent line (20) is arranged between the exit
15 or outlet (19) of the cooling device (15) of the fuel cell (1) and the gas collection region (22) of the calming vessel (23).

11. The apparatus as claimed in claim 9 or 10,
20 characterized in that the discharge passage (26) which leads away from the calming vessel (23) opens out in the gas intake system for the oxygen-containing gas in the region of a gas filter (12).

25 12. The apparatus as claimed in at least one of claims 9 to 11, characterized in that a sensor (37) for measuring the fuel gas content in the exhaust-gas stream is provided in the exhaust pipe (37) for the reaction products of the fuel cell (1) and is connected
30 to a control unit (36), in which a limit value for the fuel gas content in the exhaust-gas stream is set and by which a valve (38) in an entry to the exhaust pipe (37) can be controlled, which valve opens up an opening for admixing air to the exhaust-gas stream when the
35 limit value is reached.

13. The apparatus as claimed in at least one of claims 9 to 12, characterized in that a catalyst for reducing

the fuel gas in the exhaust-gas stream is present within the exhaust pipe (37).

14. The apparatus as claimed in at least one of claims
5 9 to 13, characterized in that the calming vessel (23),
the gas outlet valve (25) and the gas discharge passage
(26) consist of antistatic materials.

15. The apparatus as claimed in at least one of claims
10 9 to 14, characterized in that a moisture separator
(27) made from antistatic material is arranged within
the discharge passage (26).

16. The apparatus as claimed in at least one of claims
15 9 to 14, characterized by its arrangement in a mobile
device.